TECHNICAL NOTES

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The Effect of Time and Carbonizing Temperatures on Quality of Charcoal From a Cinder-Concrete Block Kiln

Charcoal produced in small cinder-concrete block kilns[1/] increases in volatile content from top to bottom of the charge according to results from nine burns on the Argonne Experimental Forest near Three Lakes, Wis. This is because carbonization begins at the top and proceeds downward through the load. However, the composition of the total kiln yields is within the requirements for good-quality, domestic-grade charcoal.

For general market acceptance, good-quality charcoal contains 75 percent or more fixed carbon, and associated volatiles should be less than 24 percent if the charcoal is not to smoke when burned.[2/]

The amount of retained volatiles depends upon the temperature during carbonization and the length of time the charcoal is held at this temperature. Volatiles decrease with an increase in either carbonization temperatures or time. Higher carbonization temperatures must be maintained in the upper levels of the kiln if the lower level temperatures are to be raised above the carbonization point; thus the volatile content of charcoal from the upper levels of the kiln load will usually be less than the volatile content from the lower levels.

For the nine burns, all kiln loads consisted of 4-foot rough sugar maple (Acer saccharum Marsh.) sticks, about 6 inches average diameter. Of the nine burns, three used green wood with center-firing and four stacks; three used air-dry wood with center-firing and four stacks; and three used air-dry wood with end-firing and one stack. To facilitate heat circulation, the 6-foot-high wood load was piled on 7-inch stringers. By using 24 evenly spaced thermocouples (8 in each 2-foot layer of the load), hourly carbonization temperatures were recorded for the 3 horizontal zones in the kiln.

In figure 1, average time-temperature curves for the nine burns illustrate why position in the load will cause charcoal to vary in volatile content. The average bottom temperatures did not reach 800° F. until 6 hours after the middle temperatures did. Previous experimental data have shown that average carbonizing temperatures should be above 800° F. at least 1 hour for good-quality charcoal.

1/ Lane, Paul H. Design of a cinder-concrete block charcoal kiln. Lake States Forest Expt. Sta. Tech. Note 494, 2 pp., illus. (Processed.) 1957.

2/ U. S. Forest Products Laboratory. Production of charcoal in a masonry block kiln--structure and operation. Rept. 2084, 32 pp. + 6 tables and 17 figures. (Processed.) 1957.

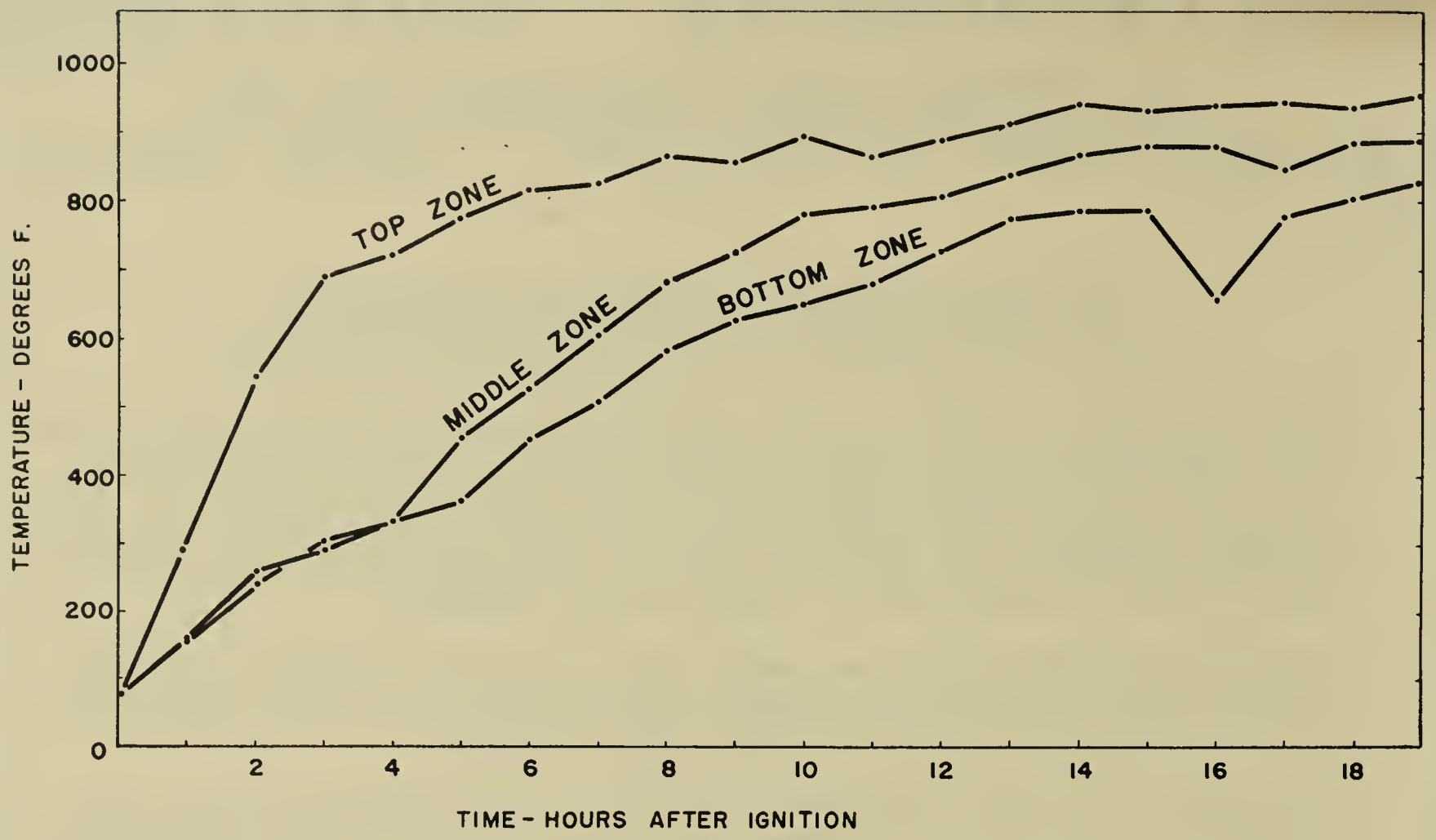

Figure 1.--Average kiln temperatures from nine experimental charcoal burns.
Note: The temperature drop at 16 hours for the lower zone was caused by restriction of air supply.

The average charcoal yield from the nine burns (103 kiln samples) was analyzed by the U. S. Forest Products Laboratory. The percentages of volatiles, ash, and fixed carbon, based on the ovendry weight of the charcoal, were as follows:

		Percent	
Volatiles:	Top third of kiln	14.48	
	Middle third	16.58	
	Bottom third	24.67	
	Average		18.58
Ash			1.74
Fixed carbon			79.68
Total			100.00

Although the average volatile content for the bottom zone is rather high, the volatile content for total charcoal yield from all nine burns does not vary significantly from the 18.58-percent average. Apparently variation in moisture content and firing methods does not affect the quality of charcoal produced in this type of kiln.

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